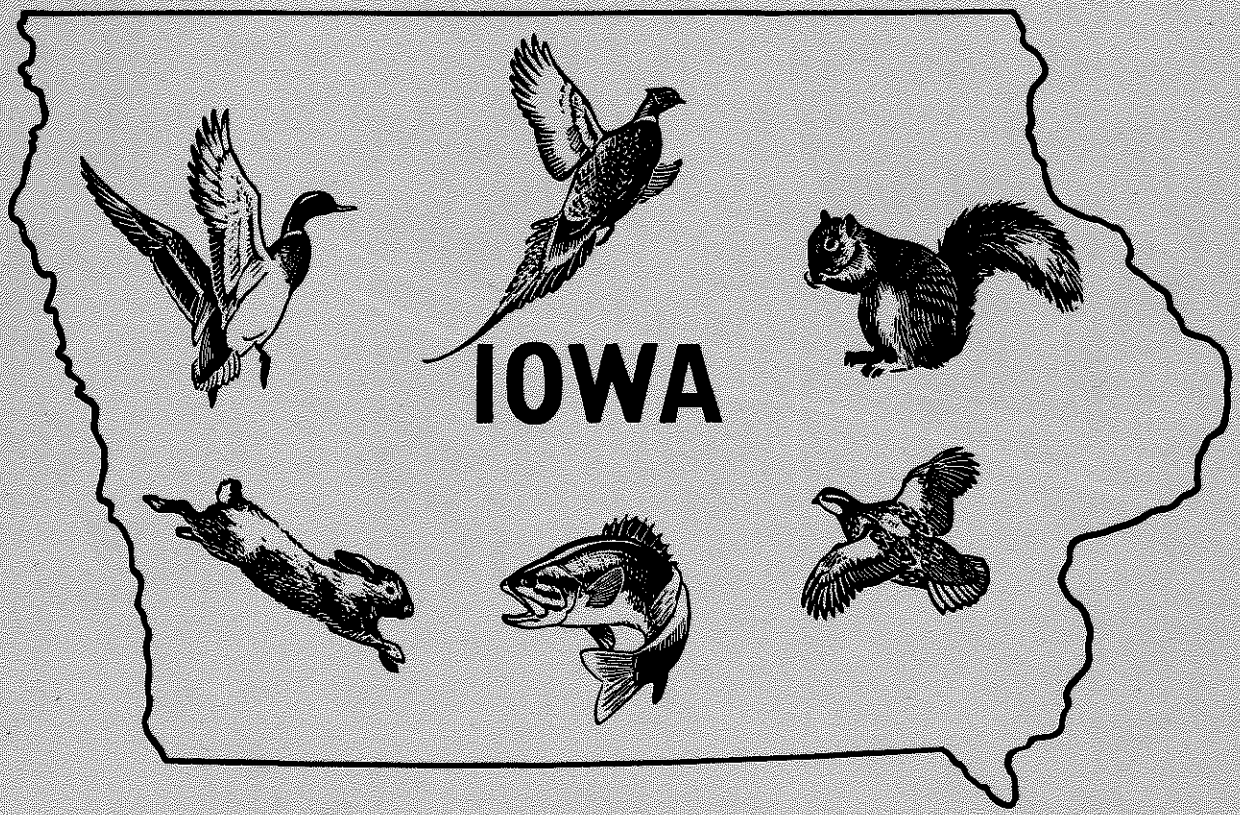
QUARTERLY BIOLOGY REPORTS



FISH AND GAME DIVISION — BIOLOGY SECTION

STATE CONSERVATION COMMISSION

Q U A R T E R L Y B I O L O G Y R E P O R T S

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Pheasant Reproduction Success

Richard C. Nomsen
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The observed pheasant sex ratio obtained from the Conservation Officers Sight Record Project last Winter was three hens per cock -- same as in 1950. Population studies last Spring showed an increase of about 8% in our 1951 brood stock.

Reproduction studies were begun in June when cards were mailed to Farmer Cooperators requesting information on nests and broods found in hayfields during mowing operations. Only 150 cards were returned compared with 275 last year.

Table No. 1 compares the results of this survey for the past two years. Counts were made during the first cutting and include all types of hay.

Table 1
Farmer Interview Nesting Survey
June - 1950 and 1951

	1950	1951
Acres of Hay Cut	6986	3377
Number of Nests Seen	609	278
No. of Nests Seen per 100 Acres	8.8	8.2
Average Number of Eggs per Nest	9.7	9.6
Number of Nests Hatched	74	62
Percentage of all Nests Hatched	11%	18%
Number of Hens Reported Injured	140	61
No. of Hens Injured per 100 Acres	2	1.8
Number of Hens reported Killed	93	30
Hens Reported Killed per 100 Acres	1.3	0.9
Number of Broods Seen	36	11
Average Number in Each Brood	8.4	9.2

Farmer Cooperators reported finding 7% fewer nests per 100 acres this year -- nests contained about the same number of eggs each year. The percentage of nests hatched increased from 11% in 1950 to 18% this year - and fewer hens were reported killed or injured. The cool damp weather in June delayed the first cutting of hay, which probably allowed more hens to bring off broods.

Weather conditions last Spring were wet and cool. For the period April 1 - July 1, temperatures averaged 3° below the normal, same as in 1950. Rainfall during that period averaged 5.6 inches above normal compared with 2.9 inches above normal for the same period in 1950. Farm crops were about two weeks behind schedule at this time.

Brood counts were taken the first half of August this year - same period as in 1950. Conservation Officers, Rural Mail Carriers and Farmer Cooperators reported over 1000 broods. Results for each survey are given separately and compared with previous years.

The Conservation Officers made their survey during the first two weeks in August. They reported all hens and broods seen while on regular patrol duty. Because of the variation of reproduction success from district to district, the results for all districts are shown in Table 2.

Table 2
Conservation Officers Sight Record Project
Reproduction

District	Young Per Adult Hen	Average Brood Size	Percent of Hens With Broods
1 North West	4.0	6.8	60%
2 North Central	3.8	5.3	71%
3 North East	2.9	5.7	50%
4 West Central	4.6	7.7	60%
5 Central	3.4	5.7	60%
6 East Central	4.5	7.0	63%
7 & 8 South W. and South C.	5.2	8.6	61%
State 1951	3.9	6.2	62%
State 1950	4.8	7.0	69%
State 1949	4.4	7.2	62%
State 1948	4.1	6.6	63%

For the State as a whole, this count shows reproduction success down about 20% from last year. Reproduction was poorest in the Northern three districts and Central Iowa -- best in West Central, East Central and Southern Iowa. Counts from Southern Iowa indicated excellent reproduction.

Counts taken by the writer in Butler and Franklin counties showed a decrease of 21% in reproduction success. A severe rainstorm crossed these two counties during the last week in June -- eight inches of rain fell at Allison in Butler county and a 6 inch rain fell over the rest of the area.

Reproduction Counts in Franklin and Butler Counties
First Half of August

Year	Young per Adult Hen	Average Brood Size	Percent of Hens With Broods
1950	4.7	7.5	62%
1951	3.7	6.4	57%

On this count, about 24% more broods were seen per 100 miles of driving than in 1950.

Counts were continued in this area through September to check for late broods. All broods seen during August and September were aged by sight to the nearest week. During the first half of September, young birds from 5-7 weeks of age were showing up in the count. At that time, most broods were from 12-14 weeks old so that the size difference was very notibeable. A total of 88 broods were observed closely enough to estimate their age. Table 3 shows these broods listed during the probable week of hatching.

Table 3
Hatching Dates of Broods Seen in
Franklin and Butler Counties

June 1st Week	11	2
June 2nd Week	111111111	9
June 3rd Week	11111111111111	14
June 4th Week	11111111111111111111111111111111111	35
July 1st Week	111111111111	12
July 2nd Week	111	3
July 3rd Week	11	2
July 4th Week	11111	5
July and Aug. 5th Week	111111	6

These late broods were hatched during the last week of July or the first week in August -- about one month following the severe rain storm. The average brood size for these late

broods was 4.1 chicks compared with 6.4 chicks for the earlier hatched broods. It is believed, therefore, that of the hens that lost their nests or young broods during the last week of June, many of them renested and brought of small broods.

Cards were sent to Farmer Cooperators during the last week of July. They were asked to give their opinion as to this years hatch (better, poorer, same) and the number of adult birds (more, less, same) as compared to 1950.

Farmer Interview Program
Summer 1951

	Hatching Success			Adult Population		
Year	Better	Poorer	Same	More	Less	Same
1951	28%	38%	34%	32%	30%	38%
1950	43%	20%	37%	42%	22%	36%

The majority of farmers cooperating in this project thought that this years hatch was poorer than in 1950, and that the adult population was about the same both years. This survey indicates that reproduction was poorest in North Central, North East and Central Iowa.

Rural Mail Carriers returned 479 cards by August 16th with information on pheasant broods. They counted birds along their routes during the week of July 30-August 4. Table 4 lists the results of this count for the last four years.

Table 4
Rural Mail Carriers Summer Count
All Districts

	1948	1949	1950	1951
Average Brood Size	6.1	6.1	6.3	5.9
Percent of Hens With Broods	39%	46%	38%	39%
Young per Adult Hen	2.4	2.8	2.5	2.3

This count indicates that pheasant reproduction success was 8 % poorer than last year. The percent of hens seen with broods increased slightly but the average brood size dropped from 6.3 to 5.9 chicks per brood. Although the rate of reproduction was lower, more broods were reported this year. The number of broods seen per 1000 miles increased 19% over 1950.

Waterfowl Prospects and Marsh Conditions Fall 1951
James Sieh
Game Biologist

Waterfowl prospects for the 1951 open season in Iowa appear better than at anytime during the last three years. This is true because there are estimated to be more waterfowl in the state and because there are more sloughs and potholes available to attract and hold migratory waterfowl during the open season. Early hunting success may be disappointing to some hunters because their bag of blue-winged teal may be smaller than usual. Blue-winged teal are not concentrated on the public shooting areas in such large numbers because the species prefer the smaller sloughs and potholes which are filled this fall and previously were dry. Since early September blue-wings have been migrating into and across Iowa in their characteristic drift or creep movement. Estimates indicate that as many or more teal are present in Iowa this fall for the opening, but that their distribution is much more widespread. Even though the kill of blue-wings in local areas may be somewhat reduced on the opening date, the overall take of this species is expected to increase on a statewide basis. In the past, waterfowl bag checks have indicated that blue-winged teal make up the majority of ducks in the hunters bag on the opening day.

Mallards are somewhat more numerous throughout the northwestern part of the state. In the Mississippi River area near Lansing many mallards were present in the bottoms on the 28th of September. If this was any indication of the remainder of the Mississippi River areas early fall shooting along the river should be better than usual. Wood ducks were also very numerous

along the Mississippi in the Lansing vicinity. Of the remaining species of waterfowl, with the exception of shoveler and coot, there has been no apparent change in numbers. Shovelers are more abundant in northwestern Iowa than during the past three years. Coot populations so far are still lower than during the past two years. There may be a decided increase in coot concentrations during the next three weeks. As yet, no sizeable migration of geese has been reported from Iowa, and with the waterfowl season about to open the prospects for a better than average goose season are slim.

The growing season of 1951 has been exceptionally good for marsh plants of almost every kind. Some aquatic plant seed crops have been poor. Usually a short period of high water is not conducive to exceptional aquatic plant growth. During 1951, however, there has been continuous high water since the spring runoff, and cool temperatures have prevailed throughout the growing season. These conditions in 1951, coupled with the cool summer and growing season of 1950, have provided for excellent aquatic plant growth during the two-year period 1950-51. The exception to this rule has been on areas where the waterlevel has been controlled at too high a stage or level and continuous wave action and high water have reduced emergent plant cover. Submergent aquatic plants have not been so drastically reduced in these areas where the waterlevel has been controlled at too high a stage for optimum emergent plant growth and survival.

Nature has provided two unusual growing seasons in a row (1950-1951). Marsh plants have responded successfully and the resulting habitat in Iowa has been of superior quality and

greatly increased in quanitity. The continuous heavy rainfall in 1951 increased the number of ponds and potholes throughout the state manyfold. Waterfowl, with the exception of coot, have utilized the improved habitat and an estimated 30% more waterfowl were present in the state during the nesting season of 1951 than were present during 1950. The largest increase included mallards, blue-winged teal, and shovellers. Wood ducks were not noticeably more abundant in 1951 than they were in 1950, but a good substantial breeding population was present both years.

In most of the public shooting areas it has been impossible to census waterfowl in the fall because most of the birds were obscured by the dense emergent plant cover. Occassionally groups of birds have been checked accurately through binoculars on the larger areas as far as species are concerned, but seldom to compare numbers. Accurate waterfowl counts have been made on some smaller areas to show how quickly the species composition of waterfowl may change as well as the total number of birds (table 1). These counts should further convince some of the skeptics as to the large number of early migrants which actually do enter the state prior to the open season. Without banding records to support casual observations there is no other practicable means of determining which ducks are migrants and what percent of these same birds remain in the state until the season opens, or what fraction of these early migrants are taken in the hunters bag. A good banding program in Iowa would go a long way toward evaluating the most effective opening date from every standpoint, and eliminate considerable guesswork.

Several marsh areas in the state have been singled out and studied to determine briefly their condition at the present

time. Each marsh mentioned represents some special change or circumstance worthy of note. Other marsh areas have been visited and some repeatedly throughout the summer to study aquatic plant development. It will be important to remember that in 1951 practically every marsh in the northwestern part of the state has been filled to capacity from spring runoff until frost in the fall. This id decidedly and unusual condition in Iowa. The effect of this continuous high water period on marsh vegetation, particularly emergent species, will not show up immediately as far as secondary effects are concerned. Marsh plant growth next year and for several year to come may show effects of this high water period. In some areas where the water depth has increased beyond the optimum there will be a loss of or reduction in the density of emergent cover species. Along the shorelines of many lakes and marshes the high water will have stimulated aquatic plant growth. Continuous high waterlevels over several growing seasons would be undesirable, however, such conditions are unlikely.

Sweet or Sweet's Marsh

This area totals about 1600 acres and lies adjacent to the Wapsipinicon River in Bremer County just northeast of Tripoli, Iowa. A system of earthen dikes and concrete control structures will impound about 1000 acres of marsh. The marsh will be divided into three segments of almost equal size and each will receive its water supply from Plum Creek, a tributary of the Wapsipinicon River.

The development of Sweet's March is still in the construction phase, but one segment of the marsh was flooded by high water

this spring (1951). The natural outlet of this marsh segment has been obstructed by diking before the spring runoff, and consequently considerable water was impounded in the southeast segment. Fortunately, the amount of water which was impounded in the southeast segment was shallow enough to initiate rapid marsh development. The grasses and sedges which were present over the greater part of the segment are now covered with several to 24 inches of standing water. Over the greater part of this flooded segment the water was not deep enough to completely inundate all the co-dominamt plant species except bluegrass (Poa pratensis). An excellent young marsh exists already, and if the water depth remains shallow the invasion of typical marsh species into this flooded area will be gradual and successful. At the present time this segment is attractive to waterfowl and related species and should provide some excellent hunting this fall.

This flooded segment cannot be spoken of as a typical or mature marsh just yet, although for all practical pruposes it amounts to almost the same thing. The obvious changes yet to come will include the dying out of portions of the oak-hickory forest which are flooded and will subsequently drown out. The majority of grasses and sedges which at present are co-dominat wet ground species will also succumb without intermittent drying. The true marsh or aquatic species can be expected to replace them providing that the waterlevels remain shallow enough to invite rapid invasion by their successors.

The shallow flooding this spring has provided for an excellent crop of smartweed (Polygonum spp.) adding to the

attractiveness of the segment for waterfowl. The seed crop of sweet flag and bur reed were only fair, but should provide for natural re-seeding and spreading of these species. Scattered clumps of roundstem bulrush (S. acutus and/or validus) are present and should provide for some scattering by vegetative reproduction in addition to a successful seed crop. Cattail (Typha spp.) are not numerous in this newly flooded segment, but if soil conditions are satisfactory they should establish themselves as a natural sequence in the young marsh. Reed grass (Phragmites spp.) was not present, and it too should establish itself if soil conditions are right and invade the area in the future. A smattering of wildrice (Zizania aquatica) is already present along the eastern edge of the new marsh segment and should provide for natural reproduction of the species if it is to be successful.

The flooded segment at present is largely covered by hummocks of slough grass (Beckmannia spp.) and cordgrass (Spartina spp.), with lesser growths of spike rush (Eleocharis spp.) and smartweed in between. In the old permanent pond bottoms the clumps of bulrush, bur reed, and sweet flag persist and are now contiguous with the new marsh. Only one of the co-dominant species, bluegrass, has been completely destroyed in the flooded areas although it still persists on the dry ground of the islands and along the margins. In the southeast segment the first step in natural succession has proved successful. Pondweeds were noticeably absent from the area at this time. The only explanation offered is that in any new or young marsh pondweeds and other entirely aquatic plants have to compete with the most hardy grasses and sedges which are wet

ground species. As soon as the marsh bottom becomes exposed mud or sand instead of sub merged sod, pondweeds and other species can be expected to appear as part of the more mature aquatic habitat.

The flooded marsh segment has already been used by waterfowl this summer and fall. On September 11, 12, and 13th the following waterfowl and wading bird count was made by the area manager, Jack McSweeny, and the writer (Table 2). According to the area manager there had been up to several hundred blue-winged teal on the area prior to this time. Some of the teal had no doubt moved to other areas when this check was made. More wood ducks had also been noted on the area by the manager prior to this count. There was ample sign of raccoon on the area. Mink and muskrat sign were present, but not in any surprising amount. In due time after the marsh vegetation is well established muskrat production should increase sharply on the marsh.

Rice Lake

The Rice Lake area in Winnebago County is the second marsh area to be mentioned specifically in this report. This area comprises 1800 acres of lake, marsh, and upland. High water during 1951 has filled this impoundment to capacity for the first time since the installation of the new control structure. Waterlevels have been raised 12 to 24 inches over the entire area. The shallow bays are now flooded to optimum depths for marsh conditions compatible with fishing interests. Additional marsh areas in the shallow bays and at the far southeast end of the lake have resulted from this additional impoundment. If this

new lake level can maintain itself over a several year period Rice Lake should be watched closely to evaluate the change. Waterlevel guages are in operation on the area and records are now being kept by the area manager.

Mississippi River Areas

A survey of the waterfowl area just north of Lansing, Iowa on the Mississippi River provided some pre-season counts of waterfowl which should indicate good hunting opening day in that area (table 3). After the opening day and the resulting bombardment it is anyone's guess as to how many waterfowl may remain in the area for the next week or two. The Mississippi River is exceptionally high for this time of year. Practically all of the islands can be reached by boat, and there will be little necessity for walking this year if high water continues throughout the open season. Most of the emergent aquatic vegetation has ample water beneath it to permit boats to pass through. There were no exposed mud flats visible when this survey was made on September 28, 1951. The river was so high that in most places it reached the roots of the big timber and many of the lower islands were flooded. According to local fishermen the river is at a twenty-year high, and such a previous fall high was before the advent of the present lock and channel system. These general statements could be checked against records of the Army Engineers for specific figures on river stages. The important thing to remember is that 1951 was an abnormally wet year and some of the changes brought about on impounded marsh lands must be dated as of 1951.

Table 1.

Early Fall Migrants (Waterfowl) in Iowa

Welch Lake, Dickinson County — Sept. 4, 1951

11 unidentified	20 shoveler
154 identified	119 blue-winged teal
	2 gadwall
	7 pintail
	6 mallard
165 total ducks counted	154 total identified by species

Welch Lake, Dickinson County — Sept.19, 1951

68 identified	33 redhead
0 unidentified	9 shoveler
	26 blue-winged teal
68 total ducks counted	68 total identified by species

Temporary Pond, Dickinson County (estimated 3 acres in size) — Sept. 4, 1951

147 identified	0 coot
0 unidentified	2 lesser scaup
	5 mallard
	1 pintail
	6 shoveler
	133 blue-winged teal
147 total ducks counted	147 total identified by species

Temporary Pond, Dickinson County (estimated 6 acres in size) — Sept. 4, 1951

48 identified	42 blue-winged teal
300 unidentified (mostly teal BWT)	6 coot
348 total ducks counted	48 total identified by species

Jemmerson's Slough, Dickinson Cty. — Sept. 19, 1951

145 identified	79 pied-billed grebe
	66 coot
	0 ducks
145 total count	145 total identified by species

Table 2.

Waterfowl and Wading Bird Count, Sweet's Marsh
September 13, 1951

4 Wood duck	36 american egret
7 black duck	20 great blue heron
11 blue-winged teal	6 pied-billed grebe
27 mallard	
45 coot	

Table 3.

Waterfowl Count on the Mississippi River North of Lansing, Ia.
September 2[illegible], 1951

415 mallard,	135 double-crested cormorant
21 black ducks	85 wood ducks
14 gadwall	485 coot
10 pintail	6 blue-winged teal

Iowa 1951 Fall Flush Count Of Quail

Elden Stempel
Game Biologist

In late Summer, 1951, letters, instructions and report blanks were sent to officers in the quail territory. In each of 28 counties, nine quail covey ranges were to be checked.

On the report form the officer reported where the check was made, name of the officer and name of the farmer where the check was made.

Three covey ranges were checked in the north, three in the central and three in the south part of one county in the territory of each officer.

The officer reported the number of quail found, roosts found, number of coveys the farmer had seen and whether there were more, less or the same number of birds compared to 1950 at the same season.

In the 1951 Fall Cencus of Iowa Quail, the officers reported that they believed there were more quail in 14 quail ranges checked, less quail in 16 ranges and the same number in 31 ranges than in Fall 1950. A total of 65 ranges were checked by officers. On the other ranges no opinion was stated.

A total of 180 quail covey ranges were checked in 1950, and 196 ranges were checked in 1951.

In 42% of the covey ranges checked, quail were found by officers in 1950. 42% of the covey ranges were also found occupied by quail in 1951.

Officers were also asked to report the number of quail roosts found. 97 roosts were reported seen in 1950 and 93 roosts were reported seen by officers in 1951.

A day or night roost is considered a positive indication that quail are present. We may add for 1950 and 1951 the number of roosts to the number of occupied ranges. Even though a roost may have been made by quail already counted, we have for the purpose of comparison, a total figure representing frequency of occupation of covey ranges.

Table of Comparative Frequency of Occupation

	1950	1951
Number of covey ranges occupied	76	83
Number of Roosts found	97	93
Total indications of occupancy	173	176

Sixteen more covey ranges were checked in 1950 than were checked in 1951.

Several officers stated that heavy cover conditions made difficult the finding of quail in 1951. A dry fall made bird finding difficult in 1950.

930 quail were found on 180 covey ranges in 1950
1029 quail " " " 196 " " " 1951

5.1 quail were found per covey range in 1950
5.2 " " " " " " " 1951

Apparently the increase in quail per covey range is at least partly due to there being in 1950 an average of 12.2 quail per covey and in 1951 there was slightly more than an average of 12.3 quail per covey found. It has already been shown that in both 1949 and 1950, 42% of the covey ranges were found to have quail.

In a sampling of covey size by the Biologist, an average figure of 12.8 quail per covey was obtained.

Heavy cover was reported in all quail ranges. Where coveys were found several hours work with dogs was required before the covey could be located.

Summary

1. There is some indication of a later than usual hatching of quail.
2. In 1950 on a sample area, 4 covey of young quail were found in early fall and 4 coveys were found on the same area in 1951. Less birds were found in 1951.
3. In both 1950 and 1951 in the fall check by officers, quail were flushed in 42% of the covey ranges checked.
4. In 1950, 12.2 quail was the average covey size. In 1951 the average covey size was 12.3 birds.
5. In 1950, 930 quail were found on 180 ranges. In 1951 1029 quail were found on 196 ranges.
6. Heavy cover made quail finding difficult in 1951. Dry weather caused difficulty in 1950.

Iowa 1951 Flush Count of Quail

County	Number of Covey Ranges		Number Quail		Number Quail Ranges Occupied		Number Roosts		Covey seen by Farmer	
	'50	'51	'50	'51	'50	'51	'50	'51	'50	'51
Adair		9		151		8		27		15
Adams	9	9	75	101	6	7	1	4	7	12
Bremer										
Buchanan										
Cedar	9	9	91	15	8	1	10	6	29	12
Clarke	9	9	34	45	4	3	20	2	36	18
Clayton	9	9	9	20	1	3		0		5
Dallas										
Davis		9		74		4		0		6
Dubuque	9	9	25	19	2	2	4		5	1
Grundy	9	9	39	24	6	5	4	4	6	3
Henry	9	9	24	10	1	2	5	1	12	6
Iowa										
Jackson	9	9	27	57	4	7	1	1	15	14
Jasper	9	9	58	62	5	3			8	4
Jefferson	9	9	30	35	3	2	1	1	6	9
Keokuck		1		7		1				2
Lee	9	9	24	15	3	1		0	6	9
Linn	9	9	14	31	2	2		3	10	2
Louisa	9	9	80	75	5	5	1	4	10	10
Mahaska	9	6	96	24	4	3	7		16	11
Monroe										
Page	9	9	4	32	1	3	5	7	2	5
Polk	9	9	100	79	6	6	4	6	8	4
Ringgold										
Scott	9	9	16	33	2	3	3	15	12	12
Story	9	9	9	17	3	2		6	3	7
Tama										
Wayne	9	9	169	92	9	9	31	6	10	6
Winn.	9	9	6	11	1	1			4	2
Totals	180	196	930	1029	76	83	97	93	205	175

Sex and Age Ratios of Cottontails in the Bag and Hunter-Success as Reported by Hunters, 1950-1951.

Glen C. Sanderson
Game Biologist

The cottontail rabbit is the "Bread and Butter" of Iowa sportsmen. Each year thousands of Iowans spend many pleasant hours rabbit hunting; nor does the pleasure end when this sporty animal is in the bag because when properly dressed and prepared for the table, rabbit is as tasty as any game bird or mammal.

In order to gain biological information from our cottontail population as well as to gain an insight into the habits of our rabbit hunters in the state, a project was initiated in the fall of 1950. Rabbit-hunter cooperators have furnished the bulk of the information contained in this report and are to be commended for their splended cooperation.

Last fall conservation officers were asked to submit a list of rabbit hunters from their respective territories; this formed the basis of our initial contacts. The officers furnished more than 1,200 names and to these were added the names of approximately 80 employees of the Conservation Commission for a total list of approximately 1,310 names from 67 counties.

In the week prior to the opening of the rabbit hunting season last fall each of these hunters received a form letter explaining the purpose of the project and instructions regarding the information we wanted them to collect for us. Enclosed with the letter was a form which asked the hunter for his name, address, type of gun used, and whether he thought there were MORE or FEWER rabbits than there were last year. There was also

a space for the hunter to record the number of right front leg bones he saved for us. In addition, the hunters were asked to record the number and sex of rabbits bagged, the number crippled, and the number seen but not killed or crippled. They were also asked to record the number of hunters in each party, the number of hours the party hunted, whether or not a dog was used, and the county in which they hunted.

It should be noted that no names of hunters were received from conservation officers for the following counties: Allamakee, Appanoose, Benton, Bremer, Butler, Clay, Clayton, Clinton, Fremont, Hancock, Harrison, Humboldt, Iowa, Jackson, Johnson, Keokuk, Mahaska, Marion, Mills, Monroe, Montgomery, O'Brien, Page, Plymouth, Pocahontas, Ringgold, Shelby, Taylor, Union, Wapello, Woodbury and Wright.

Results

Only a small percentage of the hunters contacted replied, although all were asked to return the form whether or not they did any hunting. Reports were received from 49 hunters representing 34 counties. This is approximately 3.7 per cent of the 1,310 hunters contacted (Table 1). These 49 hunters, plus 20 new names they furnished, will be used as the hunter

Table 1.--Cottontail hunters contacted in 1950.

Number of hunters contacted	1,310 in 67 cos.
Number of hunters reporting	49 from 34 cos.
Percentage reporting	3.7%
Number of hunters saving leg bones	18 (1.4%)
Number of usable leg bones saved	154
Number of new names furnished	20

contacts for next fall. Also an effort will be made to get at

least a short list of names for the counties that had no list last fall. Of the 49 hunters reporting, 18 saved 154 usable right front leg bones. In spite of a sketch showing which bone we wanted a few hunters confused the squirrel project with the rabbit project and saved rabbit radii and ulnae instead of humeri.

Population--forty-three hunters replied to the question, "Do you think there are MORE or FEWER rabbits than there were last year?" More than sixty per cent (62.8%) answered more, while approximately one-third (32.6%) said there were fewer, and two of the 43 (4.6%) said there were the same number as last year (Table 2). These opinions agree with general comments and observations made in regard to the hunting success in 1950-51 as compared with 1949.50. However, it should be remembered that weather conditions in 1950-51 were more favorable for rabbit hunting than they were in the previous year and this probably affected the hunting success and thus the opinions of the hunters.

Table 2.--Hunter's replies as to whether there were more or fewer cottontails than there were last year.

Number of hunters reporting	49
Number of hunters answering the question	43
Number who said MORE than last year	27 (62.8%)
Number who said FEWER than last year	14 (32.6%)
Number who said SAME as 1st year[1]	2 (4.6%)

[1]The question asked was "Do you think there are MORE or FEWER cottontails than there were last year?"

Kill Data--In order to determine the habits of rabbit hunters, their hunting trips were separated into those made during the first one-third, the middle one-third, and the last one-third of the season. Table 3 reveals that only

6 (2.8%) of the reported trips were made during the first one-third of the season, while 105 (49.7%) and 100(47.4%) trips were made during the second and final thirds of the season respectively. A total of 211 hunting trips were reported by the cooperating hunters. Table 3 also reveals that hunting success improved as the season progressed.

Table 3.--Hunter habits and kill during the first, middle, and last part of the open season.

Number of hunts reported during 1st third of season	6 (2.8%)
Number of hunts reported during 2nd third of season	105 (49.8%)
Number of hunts reported during 3rd third of season	100 (47.4%)
Total no. of hunts reported during the entire season[1]	211 (100%)
Number cottontails bagged during 1st third of season	5 (0.8%)
Number cottontails bagged during 2nd third of season	281 (43.4%)
Number cottontails bagged during 3rd third of season	361 (55.8%)
Total no. cottontails bagged by the reporting hunters	647 (100%)

[1]As used here a hunt means a trip by a hunting party whether it had one or a number of hunters.

This information indicates that the heavy pressure for rabbits does not come early in the season as it does for squirrels (Sanderson, 1951) and many other species.

Table 4 reveals that during the entire season an average of 1.1 rabbits was bagged for each hour a party hunted. The table further reveals that the hunting success improved markedly as the season progressed, and that the average number of rabbits seen per party per hour also increased along with the hunting success. During the first third of the season hunters saw only 0.5 rabbit per party per hour, while during the second third of the season they saw 2.0 rabbits per hour, and during the final third of the season they saw 3.1 rabbits per hour. An average of 3.1 rabbits was bagged by each party each time they went after cottontails; this figure increased as the

season progressed along with the number bagged and the number seen per hour. Apparently crippling losses are insignificant because Table 4 shows an average of less than 0.1 rabbit crippled but not bagged per party per hour.

Sex Ratio--For the entire state the reports reveal 151 females (44.0%) females among 343 rabbits reported as to sex. To state it another way there were 127 males per 100 females in the rabbits bagged in Iowa last year (Tables 5 and 6).

Table 4.--Hunter success, number of hunters per party, hours hunted, and number of hunting trips made during the first, middle, and last part of the open season.

	Sept. 15-Oct. 31	Nov. 1-Dec. 16	Dec. 17-Jan. 31	Sept. 15-Jan. 31
Total number cottontails bagged	5	281	361	647
Average no. bagged per party per hour	0.2	0.9	1.5	1.1
Average no. bagged per party per trip	0.8	2.8	3.6	3.1
Total no. crippled	0	14	33	47
Average no. crippled per party per hour	0	0.04	0.1	0.09
Total number seen but not bagged or crippled	7	323	347	677
Average no. seen but not bagged or crippled per party per hour	0.3	1.0	1.5	1.2
Total no. seen	12	618	741	1,371
Average number seen per party per hour	0.5	2.0	3.1	2.4
Average number seen per party per trip	2.0	5.9	7.4	6.5
Average number hunters per party	1.3	2.3	2.1	2.1
Total number hunts reported	6	105	100	211
Average number trips per hunter reporting	--	---	---	4.3
Total number hours hunted (party hours)	22	314	237	573
Average number hours hunted per party per trip				

Table 6 shows a slightly higher percentage of males killed during the final third of the season than were killed during the middle third of the season. This may possibly be explained by

the greater tendency for the females to hole up during periods of extreme weather making relatively more males available to hunting pressure.

Table 5.--Sex and age ratio, hunter success and opinions of hunters on cottontail population--by agricultural areas.

	I	II	III	IV	V	VI	VII	VIII	IX	Totals
No. Sexed	0	73	5	30	34	95	22	1	83	343
No. females	-	39	2	13	13	41	7	0	36	151
No. males	0	34	3	17	21	54	15	1	47	192
% females	-	53.4	-	43.3	38.2	43.2	31.4	-	28.9	44.0
M/100FF	-	87	-	131	162	132	214	-	131	127
No. sex unk.	0	7	1	50	53	62	7	13	111	304
Av. no. bagged per party per hour	-	0.6	0.2	1.9	1.4	1.2	1.1	0.9	1.6	1.2
Av. no. seen per party per hour	-	1.3	0.9	4.6	2.6	2.3	2.8	2.4	3.4	2.4
No. hunters who answered MORE or1 FEWER cottontails		7	2	5	4	8	4	4	8	43
% who said MORE than last year	0	71.4	50	75	25	88	25	50	50	62.8
% who said FEWER than last year	100	14.3	50	0	75	22	75	50	50	32.6
% who said SAME as last year	0	14.3	0	25	0	0	0	0	0	4.6
Total kill reported	0	80	6	80	87	157	29	14	194	647
No. aged	0	68	0	32	22	4	5	0	23	154
No. Juvs.	-	52	-	21	12	4	5	-	21	115
% juvs.	-	76.5	-	65.6	54.5	-	-	-	91.3	74.7
Juvs/ad F[1]	-	--	-	--	--	--	-	-	--	6.7

[1] Based on sex ratio of 44.1 per cent females as reported by hunters above.

Table 6.--Sex ratio of cottontails bagged during the first, middle, and last part of the open season.

	Males	Females	Sex unk.	% Females	M/100F
Sept. 15--Oct. 31	3	1	1	---	---
Nov. 1--Dec. 16	71	60	150	45.8	118
Dec. 17--Jan. 31	126	95	140	43.0	133
Sept. 15--Jan. 31	200	156	291	43.8	128

Although the sex ratio for each agricultural area is given in Table 5, for the most part the separate samples are too

small to be conclusive. However, the data are presented in this manner because it is hoped that more data will be available from future seasons and it is planned that the same methods will be used to present the information each year so that comparisons can more easily be made.

Age Ratio--Hale's (1949) method of aging rabbits by the presence of a line of cartilage at the proximal end of the humerus was used during this study. There were 115 juveniles (74.7%) among 154 cottontails aged (Table 5). Using the sex ratio of 44.0 per cent females reported by hunters (Table 5) this indicates 6.7 juveniles per adult female in the bag. Of course the reported sex ratio includes both juveniles and adults and the sex ratios in the two age groups may differ but if a difference exists it is probably not large enough to materially affect this computation. The 6.7 juveniles per adult female compares with the 4.2 juveniles per adult female reported from the July age-ratio counts (Sanderson, 1950). However, it should be pointed out that in July we assumed an adult sex ratio of 50 per cent females. If the July adult sex ratio was the same as that reported during the hunting season (44.0 per cent females) then there would have been a computed 4.7 juveniles per adult female in July. It should be kept in mind that when the July age-ratio counts were made some juvenile rabbits were still just a gleam in their father's eyes.

It is hoped that the number of juvenile rabbits per adult female in the hunter's bag may become one of our important indicators to productivity. This does not necessarily mean

that they will indicate the total population level.

Dogs--Contrary to what has been reported for most species of game, both birds and mammals, rabbit hunters using dogs were not more successful than hunters not using dogs. In fact, hunters not using dogs reported that they bagged 1.0 rabbit per party per hour while hunters using dogs reported that they bagged only 0.9 rabbit per party per hour (Table 7). Table 7 reveals that in all instances the use of dogs by rabbit hunters made little, if any, real difference in hunting success, crippling loss, or number of rabbits seen. The table further reveals that slightly more than 40 per cent of the rabbit hunters used dogs in their quest for cottontails.

Table 7.--Success of hunters using dogs compared with success of hunters not using dogs.

	With Dogs	Without Dogs
No. cottontails bagged	206	321
Av. no. bagged per party per hour	0.9	1.0
Av. no. bagged per party per trip	2.5	2.7
No. cottontails crippled	23	24
Av. no. crippled per party per hour	0.1	0.1
No. seen but not killed or crippled	291	366
Av. no. seen but not bagged or crippled per party per hour	1.2	1.2
Total number seen	520	711
Av. no. seen per party per hour	2.2	2.3
Av. no. hunters in party	(174)[1] 2.1	(269) 2.2
Number of hours hunted	236	314
Av. no. hours hunted per party per trip	2.9	2.6
Number of trips made	82	120
Per cent of trips	40.6	59.4

[1] Numbers in parentheses indicate number of hunters making a trip.

Type of Gun--Most hunters used shotguns, ranging from single barrel 410's to automatic 12 gauges, as their weapon for hunting rabbits. Twenty-six (60.5%) of the 43 hunters who replied to the question regarding type of gun used reported that they used a shotgun. Five hunters reported that they used a .22 caliber rifle, eight used a shotgun part of the time and a pistol part of the time. One hunter used a shotgun part of the time, a .22 rifle part of the time, and a pistol the rest of the time to get his rabbits.

Type of Hunting--Table 8 reveals that nearly 90 per cent of the rabbits were killed by hunters who were hunting primarily for rabbits. Smaller numbers of rabbits were killed by pheasant (7.1%), quail (3.5%), fox (1.0%), and squirrel (0.3%) hunters. This information indicates that rabbit hunting is a sport in its own right and does not depend upon other game species to get the hunters that kill the cottontails into the fields. It should be remembered that these reports

Table 8.--Number of rabbits killed by rabbit, pheasant, quail, fox, and squirrel hunters during the first, second, and last one-third of the rabbit hunting season.

	Sept. 15-Oct. 31	Nov. 1-Dec. 16	Dec. 17-Jan. 31	Sept. 15-Jan. 31
No. rabbits killed while rabbit hunting	3	217	334	554 (88.1%)
No. rabbits killed while pheasant hunting	0	41	4	45 (7.1%)
No. rabbits killed while quail hunting	0	18	4	22 (3.5%)
No. rabbits killed while fox hunting	0	1	5	6 (1.0%)
No. rabbits killed while squirrel hunting	2	0	0	2 (0.3%)

come from rabbit hunters. If reports were abailable from pheasant and quail hunters we would doubtless find a slightly higher percentage of our rabbits killed by hunters after these other species.

Summary

1. A rabbit project enlisting the coppcration of hunters throughout the state was initiated for the first time in the fall of 1950.
2. Of approximately 1,310 hunters contacted with a letter and form, 49 (3.7%) replied furnishing information to the study. Eighteen of the hunters replying contributed 154 leg bones to the study.
3. More than 60 per cent (62.8%) think that there were more rabbits in 1950 than there were in 1949 while one-third (32.6%) think that there were fewer, and one in fifty (4.6%) think that the population was the same in 1950 as it was in 1949.
4. Only 2.8 per cent of the reported hunting trips were made during the first one-third of the open season, while 49.8 and 47.4 per cent were made during the second and final one-thirds of the season respectively.
5. Average hunting success improved as the season progressed.
6. An average of 1.1 rabbits was bagged per party per hour, while an average of 3.1 rabbits was bagged per party per hunting trip.
7. Of 343 rabbits reported as to sex, 151 (44.0%) were females or 127 males per 100 females.
8. Of 154 rabbits reported as to age, 115 (74.7%) were juveniles. This gives a computed 6.7 juveniles per adult female in the bag.
9. Hunters using dogs had no better hunting success than hunters not using dogs.

10. Slightly more than 60 per cent of the hunters used shotguns, but some used .22 caliber rifles, and a few used pistols or a combination of two or more of the above.

11. Nearly nine-tenths of the rabbits were bagged by hunters that were out after rabbits. The other one-tenth was bagged by hunters that were hunting primarily for pheasant, quail, fox, or squirrels.

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General Survey of the Des Moines River Below Des Moines

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The species of fish living in the Des Moines River have received attention by Meek 1890, Call 1892, Harrison 1949 and Starret 1949. These papers deal only with lists of the fish in the upper reaches of the water shed and to the best knowledge of the writer, nothing concerning the fishes of the lower river has hitherto been published.

The principal purpose of this report then, is to bring together a list of the fish found in the Des Moines in its lower reaches. In addition to the species lists a physical description of the area is included and a few remarks relating to outstanding differences in the river and its fish fauna as compared to that of the upper river is also given consideration. The area covered by the report includes the main stem of the Des Moines below the Raccoon River at the city of Des Moines, as well as the important tributaries draining the watershed below that point.

Below its union with the Raccoon the valley of the Des Moines changes abruptly and markedly in both character and direction. The river has now left the narrow steep-sided valley in which it has been flowing. Here it enters a broad plain and instead of running a few degrees east of south its general direction from the Minnesota line, the valley now follows a course a few degrees south of east to the Mississippi. Geologically the Des Moines River south of Des Moines is so different from that of the river above that it could well be considered as a separate stream with the upper river acting only as a tributary. The difference is a function of age. The upper river is post-

Wisconsin while the age of the lower is post- Kansan. In general the broad valley of the lower river shows all the phenomena of maturity. The excessively flat broad flood plain across which the river winds is bordered by slopes which for the most part rise gently to the uplands although the line between flood plain and slope is well marked. However, in some places the wall may be steep and rugged and in such areas the walls and neighboring regions are much cut up by ravines and are heavily wooded. Generally speaking there is little if any relation between the character of the opposing slopes such as is the case found in the younger parts of the valley upstream. There steep bluffs face relatively short gently slopes; here the slopes facing one another may be both steep or both gently or of differenting angle The valley is now too wide for any close relationship to exist between its walls.

Contrasts in the character of the topography of the bordering region and of its tributary valleys are no less marked In- stead of flat, poorly drained prairies incised by a few short steep-sided ravines as is the case in the Wisconsin drift area above Des Moines Here the entire country is gently rolling and there are numberous long ravines and valleys. Most of them with gentle gradients and with slopes rising easily to the upland from very wide bottomes. The larger tributaries flow in valleys of remarkable width with very low gradients and gently sloping side wall.

Another feature of difference between the upper and lower parts of the river which should not be overlooked is that while the lateral streams on Wisconsin glacial plain approach the master

valley between parallel walls. The side valleys on the Kansan drift below Des Moines show widely diverging walls where they open into the main valley. These often have the appearance of a wide alluvium-filled embayments bounded by very gently sloping walls which may be one to two miles apart where they join the main valley but converge rapidly up-stream.

Below Des Moines, numberous oxbows scattered over the flood plain mark old meanders of the channel and show that the stream is practically at grade. It has long ago ceased cutting downward and has since been devoting its energies to side cutting and widening its valley. Above oxbows are practically non-existant.

Below Des Moines, the bedrock is topped by Kansan drift covered by loess. The Kansan drift is reddened by oxidation of its iron content. The contained pebbles are mostly of dark color. Above Des Moines, the land is composed of Wisconsin drift with an abundance of limestone pebbles. Igneous boulders are found in many areas in the upper valley while the exposed rocks in the lower valley are usually the product of sedementation.

With the change that take place in the physical characteristics of the river as it flows out of its young valley in the Wisconsin drift into the much older valley in the Kansan drift area of the State, a decided change in the fish fauna might be expected. This is, no less the case. Without postulating the reasons or mechanics for the changes in the fish fauna, a subject too voluminous for this report, mention will only be made to some of the most outstanding of these.

Probably the greatest difference in the fish fauna is the great reduction in the number of species found below Des Moines as compared to the upper reaches of the river. Collections in all habitat types with a wide varity of collecting gear including nets, traps and seines has turned up only 50 species for the river system below Des Moines. In 1949 Harrison listed 70 species in the Des Moines system in the Wisconsin drift area.

Another outstanding phenoma regarding the two areas is the abruptness with which certain species are either added to or fall out of the fauna with the debrouchure of the river from the Wisconsin area. To mention several of these: the spotfin shiner Notropis spilopterus, the most abundant minnow in the upper river is very rare below Des Moines whereas the plains red shiner N. l lutrensis, the most important minnow below Des Moines is not found above that city. Sand shiners N. deliciosus and the central bignouth shiner N. d. dorsalis, ranking second and third respectively from the standpoint of numbers in the Wisconsin area drop to a rank of insignificance down stream and are replaced by the emerald shiner N. a. atherinoides. On the otherhand the emerald shiner is not found in the Wisconsin region.

The rosyfaced shine N. rubellus, the common shiner N. cornutus frontalis, the hornyhead chub Hybopsis biguttata, the Bullhead minnow, Pimephales perspicuus, the johnny darter Etheostoma N nigrum, the slenderheaded darter Hadropterus phoxocephalus, the longnose dace Rhinichtys atratulus meleagris species with a rank of common to abundant in the upper river

are absent or practically so down stream. The northern creek chub Semotilus A. atromaculatus and fathead minnow Pimephales P. promelas species with a spotty distribution in the Wisconsin drift area are uniformly and generously distributed in the lower river.

Differences suchas those above are no less apparent in species of larger sizes. The gizzard shad Dorosoma cepedianum reaches its greatest development both from the standpoint of size and number in the older river and are almost absent above. The smallmouth bass Micropterus D. Dolomieu, northern pike Esox lucius, highfin sucker Carpiodes velifer, the northern and silver redhorse Moxostoma aureolum and M. anisurum respectively are absent or nearly so below Des Moines. These are species of no small consequence in the upper river.

Annotated List of Species

There follows an annotated list of species found in the Des Moines River system below the city of Des Moines. The arrangement of families and nomenclature used follows that of Bailey 1951. In addition to the annotated lists, Table I lists the fish by streams in which they occurred. In that table the letter R.,C., A., designate an occurance of rare, common and abundant respectively.

Polyodontidae

Polyodon spathula (Walbaum)

Paddle fish-rare. Not taken in our collections but included in the list on the basis of a photograph in the Ottumwa paper of a paddle fish caught in the Des Moines River near there.

Acipenseridae

Scaphirhynchus platorynchus (rafinesque)

Shovelnose sturgeon-rare. One specimen observed at the site of a fish kill at the dam in Ottumwa in the winter of 1950.

Lepiososteidae

Lepisosteus Platostomus (rafinesque)

Shortnose gar-abundant in the lower part of the Des Moines and its downstream tributaries becoming rare to absent above Ottumwa.

Lepisosteus osseus oxyurus (rafinesque)

Longnose gar-abundant in the lower river and in the mouths of its tributaries down stream. Rare to absent above.

Clupeidae

Dorosoma cepedianum (LeSueur)

Gizzard shad-abundant downstream. Common above.

Catostomidae

Ictiobus cyprinellus (valenciennes)

Bigmouth buffalo-common behind dams and in oxbows throughout the area.

Carpiodes forbesi (hubbs)

Plains carpsucker-rare. Taken but once in the present survey. This in the Des Moines River in Lee County.

Carpiodes cyprinus (LeSueur)

Quillback-abundant in all waters.

Carpiodes carpio carpio (refinesque)

Northern river carpsucker-abundant in all waters.

Moxostoma erythurm (rafinesque)

Golden redhorse-common in the upper part of the study area. Becoming rare to absent down stream.

Moxostoma aureolum (LeSueur)

Northern redhorse-rare in the upper part of the area. Absent below.

Hypentelium Nigricans (LeSueur)

Northern hogsucker-rare Found only in the upper reaches of the study area.

Catostomus C. commersoni (Lacepede)

Common white sucker-common. Distributed in small numbers throughout the area.

Cyprinidae

Cyprinus carpio (lenneaus)

Carp-abundant in all waters.

Notemigonus crysoleucas auratus (refinesque)

Western golden shiner-common to abundant in oxbows. Rare in flowing waters.

Semotilus a. atromocalatus (Mitchill)

Northern creek chub. Common in all waters.

Hybopsis storeriana (Kirtland)

Silver chub--rare to common throughout the whole area.

Hybopsis aestivalis (Girard)

Speckled--common in all waters.

Phenacobius mirabilis (Girand)

Plains suckermouth minnow--common throughout the area but in small numbers.

Notropis A. atherinoides(rafinesque)

Common emerald shiner--abundant throughout the region studied.

Notropis cornulus frontalis (Agassiz)

Northern common shiner--rare to common. The species has a rather spotty distribution. It is usually found far up the tributary streams.

Notropis bolennius (Girard)

River shiner--rare to common, occurring in the main stem of the Des Moines and downstream in the larger tributary streams.

** Notropis D. Dorsallis (Agassiz) see page 42

Notropis siilopterus (Cope)

Spotfin shiner--common in the main stem of the Des Moines down to the Polk-Warren county line. Rare to Ottumwa, absent below there.

Notropis L Lutrensis (Baird and Girard)

Plains red shiner--abundant throughout the study area.

Notropis delicosus (ssp.)

Sand shiner--abundant above Ottumwa. Common to rare downstream.

Hybognathus Hankinsoni (Hubbs)

Brassy minnow---common throughout the area.

Pimephales Perspicuus (Girard)

Bullhead minnow--rare, found only near Des Moines.

Pimephales notatus (rafinesque)

Bluntnose minnow--rare to absent. This species is usually found in portions of the stream with relatively steep gradient.

Pimephales p. promelas (rafinesque)

Northern fathead minnow--abundant throughout the area.

Campostoma anomalum pullum (Agassiz)

Central stoneroller--rare. Found only in areas with relatively steep gradients.

Ictalurus lacustris lacustris (Walbaum)

Channel catfish--abundant in all except the very small tributary streams.

Ameiurus melas melas (rafinesque)

Black bullhead--abundant in all overflow waters. Common to rare in flowing waters.

Pilodictis olivaris (rafinesque)

Flathead catfish-common in the mainstem of the Des Moines and in the larger tributaries.

Noturus flavus (rafinesque)

Stonecat--abundant in areas of exposed limestone.

Anguilla rostrata (LeSueur)

American eel--rare. A few specimens are taken each year by fishermen. None were secured in the netting observations. However, they have been taken on numerous occasions above Des Moines. Since the eel is a searunning species they have been included in the list of fish for the lower Des Moines River.

Centrarchidae

Micropterus D. dolomieu (lacepede)

Northern smallmouth bass--rare below Des Moines. Taken once in Polk county in the Des Moines and a second time in Cedar creek in Mahaska county.

Micropterus s. salmoides (Lacepede)

Northern largemouth bass-rare in the river. The few specimens present probably gained access from farm ponds where they occur abundantly.

Lepomis cyanellus (rafinesque)

Green sunfish--common to abundant throughout the area.

Lepomis n. microchirus (rafinesque)

Northern bluegill--rare in flowing water. Quite common in some oxbows.

Lepomis humilis (girard)

Orange spotted sunfish--common throughout area.

Pomoxis annularis (rafinesque)

White crappie---abundant in oxbows, common to rare in flowing waters.

Pomoxis nigromaculatus (LeSueur)

Black crappie--rare, taken only once. This specimen may have gained access to the river from an artificial lake.

Percidae

Stizostedion canadense (smith)

Sauger--rare, taken only once, then in the Des Moines River at Bonapart in Van Buren county.

Stizostedion v. vitreum (mitchill)

Walleye--common in the mainstem of the Des Moines in 1951. Walleyes eight to ten inches long were taken on sand and gravel bars in several different areas of the Des Moines. These are believed to represent a successful hatch for the year 1950.

Perca flavescens (Mitchill)

Yellow perch--rare. Taken only at widely scattered stations. Then usually one or two at a time.

Hadropterus maculatus (Girard)

Black-sided darter--rare. Found only immediately below Des Moines.

Hadropterus phoxocephalus (Nelson)

Slenderhead darter--rare. Found only in the upper reaches of the study area.

Etheostoma n. nigrum (rafinesque)

Johnny darter--rare. Found only in the upper part of the study area.

Sciaenidae

Aplodinotus grunniens (rafinesque)

Freshwater drum--common in the lower part of the area. Rare to absent above.

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* Notropis D. Dorsalis (Agassiz) (description ommitted from page 39) Central bigmouth shiner--Abundant in the upper part of the drainage system, becoming rare down stream.

Table I.
Species of fish by streams in which they occurred in the Des Moines River drainage below Des Moines.

Species	Streams												
	Des Moines	Lick Creek	Sugar Creek	North River	Middle River	South River	Whitebrest Cr.	Teeter Creek	Tracy Creek	Coal Creek	Soap Creek	Big Indian Cr.	Chequist Cr.
Polyoden Spathula Paddlefish	R	-	-	-	-	-	-	-	-	-	-	-	-
Scaphirhynchus Platorynchus Shovelnose sturgeon	R	-	-	-	-	-	-	-	-	-	-	-	-
Lepisosteus Platostomus Shortnose gar	C	-	-	-	-	-	-	-	-	-	-	-	-
Lepisosteus Osseus Oxyurus Longnose gar	C	-	-	-	-	-	-	-	-	-	-	-	-
Dorosoma Cepedianum Gizzard shad	A	-	-	-	-	-	-	-	-	-	-	-	-
Ictiobus Cyprinellus Bigmouth Buffalo	C	-	-	-	-	-	A	R	-	C	-	-	-
Carpiodes Forbesi Plains carpsucker	R	-	-	-	-	-	-	-	-	-	-	-	-
Carpiodes Cyprinus Quillback	A	C	A	C	C	C	C	A	C	C	C	C	C
Carpiodes C. Carpio Northern river carpsucker	A	C	A	C	C	A	C	C	C	A	C	A	C
Moxostoma Erythrurum Golden redhorse	R	-	-	R	-	R	-	-	-	R	-	-	-
Moxostoma Aureolum Northern redhorse	R	-	-	-	R	-	-	-	-	-	-	-	-
Hypentelium Nigricans Northern hog sucker	R	-	-	-	-	-	-	-	-	-	-	-	-
Catostomus C. Commersoni Common sucker	C	C	C	R		R	C	C	C	C	C	C	C
Cyprinus Carpio Carp	A	A	A	A	A	A	A	A	A	A	A	A	A
Notemigonus Cyrsoleucas Auratus Golden shiner	R	-	-	-	-	-	-	-	R	R	-	-	-
Semotilus A Artomaculatus Northern creek chub	C	A	A	C	C	C	A	A	A	A	A	A	C
Hybopsis Storeriana Silver chub	C	-	-	-	-	-	C	-	R	-	-	-	-
Hybopsis Aestivalis Speckled chub	C	-	-	-	-	-	-	-	-	-	-	-	-
Phenacobius Mirabilis Suckermouth minnow	C	C	C	R	C	C	C	C	C	C	C	C	R
Notropis A. Atherinoides Emerald shiner	A	A	A	A	A	A	A	A	A	A	A		A
Notropis Cornutus Frontalis Common shiner	R	-	-	-	R	-	-	-	-	R	-	-	-

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	Des Moines	Lick Creek	Sugar Creek	North River	Middle River	South River	Whitebrest Cr.	Teeter Creek	Tracy Creek	Coal Creek	Soap Creek	Big Indian Cr.	Chequist Cr.
Notropis Blennius River shiner	R	-	-	-	-	-	-	-	-	-	-	-	-
Notropis D. Dorsalis Central bigmouth shiner	C	C	R	-	C	C	R	-	-	-	-	R	R
Notropis Spilopterus Spotfin shiner	R	-	-	-	-	-	-	-	-	-	-	-	-
Notropis L. Lutrensis Plains red shiner	A	A	A	A	A	A	A	A	A	A	A	A	A
Notropis Deliciosus Sand shiner	C	A	C	A	A	C	C	C	C	C	R	R	A
Hybognathus Hankinsoni Brassy minnow	C	R	R	R	R	R	R	R	R	A	R	R	R
Pimephales Perspicuus Bullhead minnow	R	-	-	R	R	R	-	-	-	-	-	-	-
Pimephales Notatus Bluntnose minnow	R	R	-	R	A	A	-	-	-	R	R	-	C
Pimephales P. Promelas Fathead minnow	A	C	A	A	A	A	A	A	A	A	A	A	A
Campostoma Anomalum Pullum Stoneroller minnow	C	C	-	R	C	-	-	-	-	C	-	-	-
Ictalurus L. Lacustris Channel Catfish	A	A	A	A	A	A	A	A	A	A	A	A	A
Ameiurus M. Melas Black bullhead	C	A	A	A	A	A	A	A	A	A	A	A	A
Pilodictis Olivaris Flathead catfish	C	-	-	-	-	-	-	-	-	-	-	-	-
Noturus Flavus Stonecat	C	-	-	-	-	-	-	-	-	-	-	-	-
Anguilla Rostrata American eel	R	-	-	-	-	-	-	-	-	-	-	-	-
Micropterus D. Dolomieui Smallmouth bass	R	-	-	-	-	-	-	-	-	C	-	-	-
Micropterus S. Salmoides Northern largemouth bass	R	-	-	-	R	-	-	R	R	-	-	-	-
Lepomis Cyanellus Green sunfish	C	R	C	R	R	C	C	C	C	C	C	A	C
Lepomis M. Macrochirus Bluegill	R	-	-	-	-	-	-	-	-	-	-	-	-
Lepomis Hunilis Orangespotted sunfish	C	R	C	R	-	-	C	-	R	-	-	R	R
Pomoxis Annularis White crappie	C	R	-	-	-	-	R	-	R	C	-	-	R

Continued on next page

	Des Moines	Lick Creek	Sugar Creek	North River	Middle River	South River	Whitebrest Cr.	Teeter Creek	Tracy Creek	Coal Creek	Soap Creek	Big Indian Cr.	Chequist Cr.
Pomoxis Nigromaculatus Black crappie	R	-	-	-	-	-	-	-	-	-	-	-	-
Stizostedion Canadense Sauger	R	-	-	-	-	-	-	-	-	-	-	-	-
Stizostedion V Vitreum Walleye	C	R	-	-	-	-	R	R	R	-	-	-	-
Perca Flavescens Yellow perch	R	-	-	-	-	-	-	R	-	C	-	-	-
Hadropterus Maculatus Blackside darter	R	-	-	-	-	-	-	-	-	-	-	-	-
Hadropterus Phoxocephalus Slenderhead darter	R	-	-	-	-	-	-	-	-	-	-	-	-
Etheostoma N. Nigrum Johnny darter	R	C	-	R		R	-	-	-	-	C	R	-
Aplodinotus Grunniens Freshwater drum	R	-	-	-	-	-	-	-	-	-	-	-	-

Investigations On Northeast Iowa Smallmouth Streams

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In 1949 a series of representative smallmouth streams were chosen and annual checks as to their production capabilities were made from then to the present. Streams providing smallmouth fishing follow no set pattern. Consequently these test streams were chosen to embody all the characteristics present in the streams of this area. Turbidity varies from actually muddy to crystal clear, and bottoms run from bedrock, sand, gravel to clay and silt. The streams vary in length, size and volume of flow from creeks under 30 miles in length and averaging less than 20 feed in width to streams over 60 miles long and averaging 50 feet in width.

Permanent check stations on the test streams, besides furnishing us with annual data as to production, also give indications as to factors limiting this production. Since other phases of this investigation lack adequate data at present, this paper will be limited to a discussion of smallmouth production and the factors which affect it.

Factors Affecting Nesting

In streams and feeder creeks, the volume of nests depends primarily upon two factors: the relative abundance of brood bass and the water stage in the creeks and streams at the time there is a physiological nest building urge. Temperature seems to have an important role in this urge, and when water temperatures reach the high 50's, the adult bass seek out suitable nesting sites which can either be in the major rivers themselves or in creeks and streams feeding into them.

In Northeast Iowa, the major rivers are usually swollen by spring floods at this time and most of the brood bass in the rivers run up the feeder streams to seek out preferential spawning habitat.

Whether this spawning migration out of major rivers is due to lack of suitable spawning habitat in the rivers or whether this is a physiological urge similar to the anadromous activities of Salmon or eel is a matter of conjecture. Be that as it may, there is definitely a spawning "run" differing in proportions only with the size of the stream, being much more concentrated on the small creeks of limited flow than on the larger streams where the bass can over winter in the lower reaches and move upstream in a less apparent fashion.

The male smallmouth chooses its nest site with care, often constructing two to three nests till it finally settles on one as fitting. The nests are dished out down to coarse, egg-size rubble, and how the bass knows that under 2" or more of sand, silt or even clay that rubble is present, is one of Nature's mysteries. Exceptionally good sites are used year after year if they remain physically unaltered.

The nests are constructed in pools or back waters or near obstructions to direct current. Shifts in a channel or current direction will cause the nest to be abandoned either before or after the eggs are deposited. Minimum water velocity is a prime requisite to nest building.

Three years' investigation on these streams have brought to light numerous limiting factors controlling nesting.

Assuming the optimum water temperature of 60° F. remains in the tolerance range (bass will desert nests if the temperature

drops below 50° F. for any appreciable length of time), and assuming that the volume of water is adequate to permit easy passage over all sand flats or riffles, the smallmouth will ascend these streams proportionate to the size of the stream, the number of available streams in the area, and the number of adult bass in the area. The nesting concentration is tremendously increased in certain areas where feeder streams are at a minimum. Harrison has found that on a small feeder creek to the Des Moines River in Boone County, one of the few in the county, that 75 to 100 nests per mile of creek are not uncommon.

Certain factors such as lack of minimum velocity pools, due to an overly steep gradient or caused by sand filling up holes and spreading the force of current from bank to bank will definitely limit nesting in that reach of stream. Areas in a stream lacking bends or in streams which have been straightened or ditched are definitely avoided by nesting smallmouth. Stream straightening is rapidly becoming a definite threat to some of our prairie streams. Not only is the straight gut devoid of suitable nesting habitat, but the area immediately below suffers from siltation, the source of which being bank cave-ins caused by the straightened creek eating out the soft portions of its man-made banks.

Assuming the optimum nesting conditions are present, the most important factor of smallmouth production, that of survival, is to be considered next.

Factors Influencing Production

Water volume and water temperature are again the most important factors. Here in Iowa a sharp drop in water temperature

one to the high 40's is not the problem it is in the more northern latitudes. However, in 1951 we had just such a drop while the reproduction was in the egged stage, but it was felt that not too much damage was done since this lag was of short duration.

However, in 1950 and 1951, torrential rains in certain areas caused flash floods on all of our test streams and caught a good percent of the year's reproduction in the "black fry" stage, causing a severe drop in survival (see Table 1). Both years saw an increase in the nesting activities but high water at the critical period in developement nullified this potential boost to production.

Just how many of the washed out fry survived is impossible to determine, but we have evidence found in seining some of the overflow ponds that some escaped the flooding by being driven out into the overflow. Streams with flat flood plains were usually the ones to exhibit reproduction survival after a flood. In like manner streams which had a more circuitous route to their mouth offering obstruction to slow down the driving force of the flood waters were more productive than those which had long stretches of straight channels.

This apparent loss of a year's hatch was compensated in some instances by the survial of smallmouth fry in the upper reaches of the stream, outside the test area and the presence of smallmouth fingerlings in small creeks or drainage ditches of a few miles in length. Both of these areas were not subjected to the extreme force of flood waters.

Both in 1950 and 1951 numerous cases of renesting were in evidence, but in 1951 these renesting efforts were seemingly nullified by successive flash floods which came at 2-week intervals and extended well into the month of August.

The full impetous of reduced reproduction in 1950 and 1951 will not be felt till next year, but it is hoped that the excellent survival of the 1948 and 1949 hatch will be adequate to take care of angling pressure in 1952 and possibly 1953. There is, however, an apparent lack of 5" - 7" smallmouth in streams this year.

It is also gratifying to note that smallmouth fingerlings were taken at river survey stations which had not given evidence of them in the last two years. It is therefore a valid assumption with the rivers in worse shape this year for spawning than they have been for the last three years, that these smallmouth fingerlings are those washed out of some feeder streams in the area and survived to fingerling size in the river proper.

Table 1

Nest, Brood Bass and Reproduction Count on the Smallmouth Test Streams in Northeart Iowa for the Years 1949, 1950 and 1951

Stream	Nest / mile			Brood Bass / mile			No.Fing./500 ft.		
	'49	'50	'51	'49	'50	'51	'49	'50	'51
Lime Creek	9	21	29	13	18	18	32	0	0
Bear Creek	13	19	14	15	17	9	20	0	2
Silver Creek	8	8	13	9	5	7	6	0	0
Pine Creek	5	16	24	7	10	5	13	0	0
Coffins Creek	6	18	7	28	15	4	3	0	0
Lamont Creek	10	2	4	25	1	2	1	0	0
Rock Cr.(Mitchell)	-	9	9	-	2	9	-	12	1
Indian Creek	8	12	-	10	4	-	7	2	0
Volga River	38	41	46	87	17	7	11	2	1
Lt. Turkey R.	28	21	15	22	2	8	10	0	0
Crane Creek	26	-	37	67	-	4	4	0	0
Buffalo Creek	1	8	-	3	2	-	1	1	4
Sugar Creek	-	-	-	-	-	-	1	0	0
Rock Creek	-	-	-	-	-	-	5	0	0
Wolf Creek	-	-	-	-	-	-	0	0	0
Prairie Cr.	-	-	-	-	-	-	0	0	0
Pony Creek	-	-	8	-	-	-	15	0	3

- Not investigated or turbidity reduced or prevented true count.

The 1951 Lake Survey

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As usual, the past quarters work has been confined principally to the routine lakes survey. This report will cover briefly the pertinent results of these investigations and again as in the last year's report, some details of the so-called "problem lakes". Previous reports on this season's work were in the form of generalizations; however this season's results of the principal findings are reported for each lake surveyed. With this anyone may at a glance obtain a fairly good picture of the structure of the fish population of any lake in Iowa.

The surveys were conducted as usual, using 500 feet of ¼ inch mesh seine and 4,3' X 6' pond nets for obtaining samples of fish populations. Gill nets are used infrequently due to the high mortality of fishes caught in the 12 to 16 hour sets. For convenience and brevity the results are tabulated. The number of hauls and stations seined on each lake is noted in the tables and when followed with a plus sign (+) indicates that pond nets were used in obtaining data. Since it would be impractical to include numbers of fishes obtained, their size, weight and age in the tables, only the dominant species obtained are indicated. Where heavy reproduction of a particular species was found it is marked with an asterisk (*). Bottom fauna samples are obtained with a Peterson dredge which covers 100 sq. inches of lake bottom. The insects obtained are screened from the mud and debris, then measured volumetrically. Allwolumes in excess of 0.1 ml. are considered good and when high turbidities do not prevail it is seldom that stunted fish populations occur. The principal forms of insects found are larval Chironomids and

nymphs of Ephemerida, Neuroptera with occasional larvae of Trichoptera. The other categories of the tables are self explanatory.

The Problem Lakes

Again attention is called to certain lakes in which special efforts have been made toward restoring good angling These include several that were discussed last year, Spirit, Five Island, North Twin and Blackhawk.

Spirit Lake

As in 1950, this season was good for the production of walleys. This species apparently is well on its way toward recovery to its former important status in the lakes fishery. The apparent significance of fry stocking during the past three (3) years om the production of fingerlings and the upward trend in yearling, sub-adult and adults in the survey hauls is illustrated in the table and histogram.

Several years more data must be accumulated before conclusions can be drawn concerning the effect of the fry stocking on adult populations. Also, this data must be coordinated with gill-net records during spring hatchery operations and creel census data. The inter-specific relationships must also be considered in this problem. This year we have had the best reproduction in yellow perch in 5 years and also the greatest number of the spot-tail shiner (Notropis Hudsonius) in 7 years (at Least). These provide tremendous quantities of forage, with consequent less predation on the young of the year walleyes and assisting greatly in fingerling survival. The white bass, a top-ranking predator, is still apparently low in populations even though good hatches occurred in 1945, 1947 and 1949. North-

this lake's fauna from some unknown source, and may become a dominant species. The vast minnow population present in 1950 has practically disappeared, due in part at least to the abundant yearling yellow bass. The effects of the reduction of fish by seining and predation can be determined next summer to a much greater degree than is evident at this time.

Blackhawk

Gizzard shad remain an extremely acute problem in this lake. Adult shad are apparently somewhat reduced in numbers from this spring's seining; however the young-of-the-year are as abundant as ever. The predator stocking program designed to reduce this annual crop of shad is surviving, especially the walleye and northern pike. A continuation and expansion of this program is necessary if satisfactory results are to be obtained. Bottom fauna is practically absent. Our data indicates that the formerly abundant crappie, largemouth bass and bluegill are continuing to decline.

Summary

1. An attempt was made to digest this year's survey data on 23 natural lakes and 14 artificial lakes, into tabular form to show the high-lights of each lake's biota.

2. The past season has been generally very good for the production of game fish of most species.

3. All indications point toward a return of the walleye to its former importance to the sport fishery of Spirit Lake.

4. Corrective stocking of certain problem lakes is discussed.

A Comparison of the Walleye Fingerlings and Yearlings Obtained in Surveys during Years of no Fry Stocking, and of Stocking of Fry.

Year	Fry Acre	Fingerlings	No. Hauls	Fingerling per haul	Yearlings per haul	
1944	0	117	11	10.6	0	NO
1945	0	1	11	0.09	0.65	FRY
1946	0	41	15	2.7	0.40	STOCKED
1947	0	183	14	13.07	2.60	
1948	0	167	10	16.70	3.60	
1949	3000	426	10	42.60	2.50	
1950	3000	1,236	9	137.30	4.00	FRY
1951	3000	418	11	38.00	47.00	STOCKED